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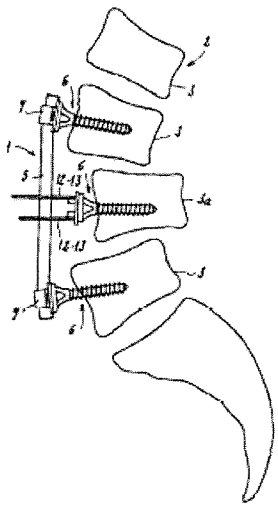
54. **Vertebral arthrodesis device**

57. This device (1) comprises at lest one rigid rod (5) to support the vertebral column (2), anchoring mechanisms (6) of the device (1) to the vertebrae (3, 3a), the heads (6b) of which anchoring mechanisms are shaped to receive a support rod (5) and locking mechanisms (7) that can be placed over these heads (6b) to lock this rod (5) to these heads (6b).

The invention teaches that each anchoring mechanism (6) comprises at least two wires (12, 13), one (12) of which is located on one side of the head (6b) of the anchoring mechanism (6) and the other (13) of which is located on another side of this same anchoring mechanism (6) in a direction transverse to the support rod (5) that is to be attached to this anchoring mechanism (6); these wires (12, 13) are of a length such that the support rod (5) that is to be attached to the anchoring mechanism (6), can be engaged between them, are made of a material such that they can be twisted together after the engagement of the rod (5) between them, and are oriented with respect to each other so that once they are twisted, they do not interfere with the installation of the corresponding locking mechanism (7).



This invention relates to a vertebral arthrodesis device of the type used to immobilize a portion of the vertebral column, for example in the case of pathological degeneration between two vertebrae, or to straighten and support a vertebral column that is abnormally curved, such as in cases of scoliosis, kyphosis or spondylolisthesis.

A device of this type generally comprises:

- at least one rigid spinal support rod that is designed to be oriented parallel to the axis of the vertebral column, on one side of the spinous processus of the vertebrae,

- mechanisms to anchor the device to the vertebrae, generally pedicle screws or hooks, the heads of which are shaped to hold a support rod, and

- locking mechanisms that can be put in place on these heads to lock this rod to these heads.

The device can also include crosspieces that connect the support rods to each other transversely.

The head of an anchoring mechanism is frequently shaped like a tuning fork, i.e. it has two projecting sides that define between them a channel that is designed to receive a support rod. The corresponding locking mechanism is frequently constituted by a nut, a threaded bolt or a bracket that is engaged with this head to clamp the rod in position between the bracket and the head.

In practice, the screws or hooks are implanted in the vertebrae and each rod is deformed sufficiently so that it is appropriate to the correction of the vertebral column that is to be realized.

The vertebrae are then moved to bring the heads of these screws or hooks into engagement with the rod or rods, thereby realizing the correction.

In practice, this operation is relatively difficult and delicate to perform, considering the forces that have to be exerted on the vertebrae in the event of a curvature of the vertebral column or spondylolisthesis and the need to keep the heads of the different screws in provisional engagement with the rods while these locking mechanisms are put in place and closed.

In addition, a defective conformation of one or both rods may necessitate the release of these rods to make the necessary modification, which requires relatively long and

tedious operations including the removal of the locking mechanisms, the movement of the vertebrae and the re-installation of these locking mechanisms.

The object of this invention is to eliminate these major practical disadvantages.

The device claimed by the invention includes, in a manner that is itself described in the prior art, at least one support rod, anchoring mechanisms, the heads of which are shaped to receive a support rod and locking mechanisms of the screw or screws on the anchoring mechanisms as described above.

The invention teaches that each anchoring mechanism includes at east two wires, one of which is located on one side of the head of the anchoring mechanism and the other of which is located on another side of this same anchoring mechanism, in a direction transverse to the support rod that is to be attached to this anchoring mechanism; these wires are of a length such that the support rod that is to be attached to the anchoring mechanism can be engaged between them, are made of a material such that they can be twisted with each other after the engagement of the rod between them so that they are in contact against this rod, thereby making it possible to progressively bring the rod and said head closer together, and are placed one in relation to the other so that once they are twisted, they do not interfere with the installation of the corresponding locking mechanism.

The operation of moving of the vertebrae to bring the heads of the anchoring mechanisms into engagement with a support rod is therefore relatively simple and can be done quickly, in complete safety, by engaging the wires of each anchoring mechanism around the support rod and by twisting these wires until this rod is brought close to the head of the anchoring mechanism. The wires then provisionally hold the support rod in this position to provide an opportunity to verify whether the conformation of this rod is correct. If the conformation is not correct, the wires can be untwisted completely or partly to release the rod in an operation that can also be executed easily and quickly, and then twisted together again to bring the rod close to the anchoring mechanism.

The installation of the locking mechanisms can be performed easily when the rod is held on the heads of the different anchoring mechanisms. Once this installation has been completed, the wires are cut at the level of the heads of the anchoring mechanisms.

Each anchoring mechanism can include only two wires as described above or can advantageously include at least two additional wires, forming at least one additional pair of such wires which is/are offset in the axial direction of the support rod with respect to the above mentioned first two wires.

This plurality of pairs of wires makes it possible to ensure that the support rod and the anchoring mechanisms are correctly brought close to one another.

The invention is described in greater detail below with reference to the accompanying schematic drawing which illustrates, in a non-limiting fashion, one preferred exemplary embodiment of the arthrodesis device which is the object of the invention.

Figure 1 is a side view during the installation of the device on a vertebral column that exhibits spondylolisthesis;

Figure 2 is a side view of an anchoring mechanism that is part of the device;

Figures 3 to 7 are views of this anchoring mechanism as well as of a support rod and a locking mechanism that is also included in the device, during different steps in the implantation of the device;

Figure 8 is a view in perspective of one variant of said anchoring mechanism, and

Figure 9 is a view of another type of anchoring mechanism.

Figure 1 shows a vertebral arthrodesis device 1 of the type used to immobilize a portion of a vertebral column 2 or to correct an abnormal curvature of this vertebral column. In the illustrated example, the device 1 is implanted to correct a spondylolisthesis, i.e. the forward displacement of a vertebra 3a in relation to the other vertebrae 3 of the vertebral column 2.

The device comprises two rigid rods 5 for the support of the vertebral column 2, pedicle screws 6 to anchor the device 1 to the vertebrae 3, and brackets 7 that are designed to be placed over the heads of these screws 6 to lock the rods 5 to these heads.

The two rods 5 are designed so that they can be deformed as appropriate so that they can be adapted to the correction being performed, as shown in Figure 1, and can then be oriented parallel to the axis of the vertebral column 2, one on each side of the spinous processus of the vertebrae 3.

Figures 2 to 8 show that each of the screws 6 comprises a threaded body 6a which is designed to engage with a vertebra 3 and said head 6b.

The latter comprises two pairs of projecting sides 10, defining between them a channel 11 that is designed to receive a rod 5, and four wires 12, 13 that are located on either side of these sides 10.

The latter are sized so that they are slightly flexible in the direction transverse to the channel 11, so that when they are brought closer together, they can clamp in place the rod 5 which is engaged between them.

Of the wires 12, 13, two wires 12 are located on one side of this channel 11 and the other two wires 13 are located on the other side of this same channel. Each of these wires 13 is located opposite one of the wires 12, in a direction transverse to the channel 11.

The two wires 12, 13 that are located on a given side of the channel 11 are placed at a distance from each other that is greater than the width of a bracket 7, as shown in Figure 6.

The figures show that the wires 12, 13 are of a length such that each rod 5 can be engaged between the wires 12, 13 of each screw 6, whether the screws 6 in question are inserted in the vertebrae 3 that are positioned normally or screws 6 that are inserted in the vertebra 3a, the position of which is to be corrected.

These wires 12, 13 are made of a metal material such that they can be twisted together (Figure 4) after the rod 5 is engaged between them (Figure 3). They can thereby come into contact against this rod and make it possible to progressively bring the rod and the screw closer together, until the rod 5 arrives in the channel 11 (Figure 5).

Each bracket 7 has the overall shape of an upside-down U. Each bracket is shaped so that it partly surrounds the rod 5, and the two lateral arms of this bracket 7 are shaped so that they come in contact against the outside surface of the sides 10.

The head 6b comprises two threaded holes 15 (see Figures 8 and 9), one on either side of the channel 11, and said lateral arms of the bracket 7 are pierced longitudinally by two holes that face these holes 15 when the bracket is put in place over the head 6b.

These holes can receive clamping screws 16 that hold the bracket 7 against the head 6b (Figures 6 and 7).

The entire assembly is shaped so that these lateral arms displace the sides 10 so that they come closer together when the bracket 7 is moved toward the head 6b as a result of the tightening of these screws 16.

In practice, the screws 6 are implanted, and then each rod 5 is engaged between the wires 12, 13 of the corresponding screws. The wires 12, 13 are then twisted until the rods 5 enter the channels 11. The wires make it possible to provisionally hold the rods 5 in this position to allow the correct conformation of these rods to be verified. If the conformation of the rods is not correct, the wires 12, 13 can be untwisted partly or completely to release the rod or rods 5, then twisted together again to bring this rod or these rods 5 into the channels 11.

When said conformation is correct, the brackets are put in place and tightened by means of the screws 16, after which the wires 12, 13 are cut at the level of the heads 6b.

The invention therefore provides a vertebral arthrodesis device that eliminates the disadvantages of similar devices of the prior art. The operation of moving the vertebrae to bring the heads of the anchoring mechanisms into engagement with the support rods is made relatively fast and easy, thanks to the wires, under conditions of complete safety, especially in cases of scoliosis or spondylolisthesis requiring the exercise of a significant force on the vertebral column to bring it into the correction position.

It goes without saying that the invention is not limited to the exemplary embodiment described above, but that it includes all variant embodiments. For example, each head 6b may include only a single pair of wires 12, 13 as shown in Figure 8; the device can include hooks as shown in Figure 9 for its anchoring to the vertebrae, at the level of the lamina, in addition to or instead of the screws 6, as well as crosspieces that connect the support rods to each other transversely.

CLAIMS

1. Vertebral arthrodesis device (1) comprising:

- at least one rigid support rod (5) for the vertebral column (2) that is designed to be oriented parallel to the axis of the vertebral column, on one side of the spinous processus of the vertebrae (3, 3a).

- anchoring mechanisms (6) for the device (1) to the vertebrae (3, 3a), generally pedicle screws or hooks, the heads (6b) of which are shaped to receive a support rod (5), and

- locking mechanisms (7) that can be put in place over these heads (6b) to lock this rod (5) to these heads (6b);

device (1) characterized in that each anchoring mechanism (6) comprises at least two wires (12, 13), one (12) of which is located on one side of the head (6b) of the anchoring mechanism (6) and the other (13) of which is located on another side of this same anchoring mechanism (6) in a direction transverse to the support rod (5) which is designed to be attached to this anchoring mechanism (6); these wires (12, 13) are of a length such that the support rod (5) that is to be attached to the anchoring mechanism (6) can be engaged between them, are made of a material such that they can be twisted together after engagement of the rod (5) between them so that they are in contact against this rod and to allow the rod and said head (6b) to be brought progressively closer together, and are placed one in relation to the other so that once they are twisted, they do not interfere with the installation of the corresponding locking mechanism (7).

2. Device as recited in Claim 1, characterized in that each anchoring mechanism (6) comprises two wires (12, 13).

3. Device as recited in Claim 1, characterized in that each anchoring mechanism (6) comprises at least two additional wires (12, 13), forming at least one additional pair of such wires (12) offset in the axial direction of the support rod (5) in relation to the first two wires (12, 13) mentioned above.

4. Device as recited in one of the Claims 1 to 3, characterized in that the head of each anchoring mechanism (6) comprises two projecting sides (10) that between them define a channel (11) to hold a support rod (5).

5. Device as recited in Claim 4, characterized in that the sides (10) of an anchoring mechanism (6) are sized so that they are slightly flexible in the direction transverse to the channel (11), so that when they are brought closer together they can clamp in position the rod (5) that is engaged between them, and in that each locking mechanism (7) has the overall shape of an upside-down U shaped so that it can partly surround the rod (5), the two lateral arms of this mechanism (7) being shaped so that they come into contact against the outside surfaces of the sides (10), the entire assembly being shaped so that said arms move the sides (10) toward the position in which they are closer together when this mechanism (7) is moved toward said head (6b).

6. Device as recited in one of the Claims 1 to 5, characterized in that it comprises crosspieces that connect the support rods to each other transversely.

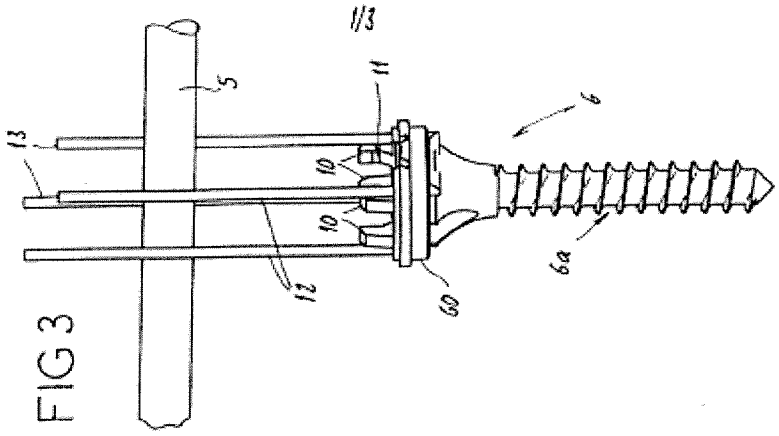


FIG 3

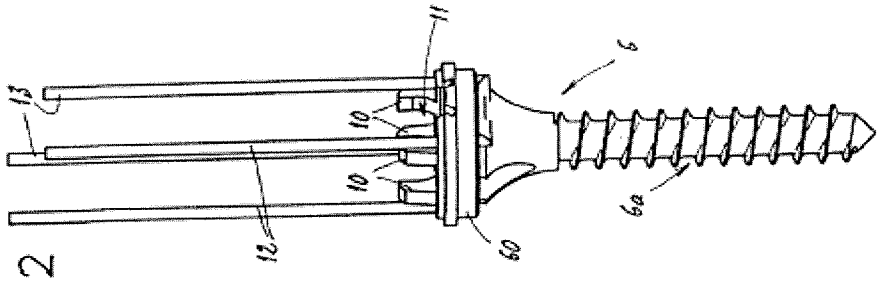


FIG 2

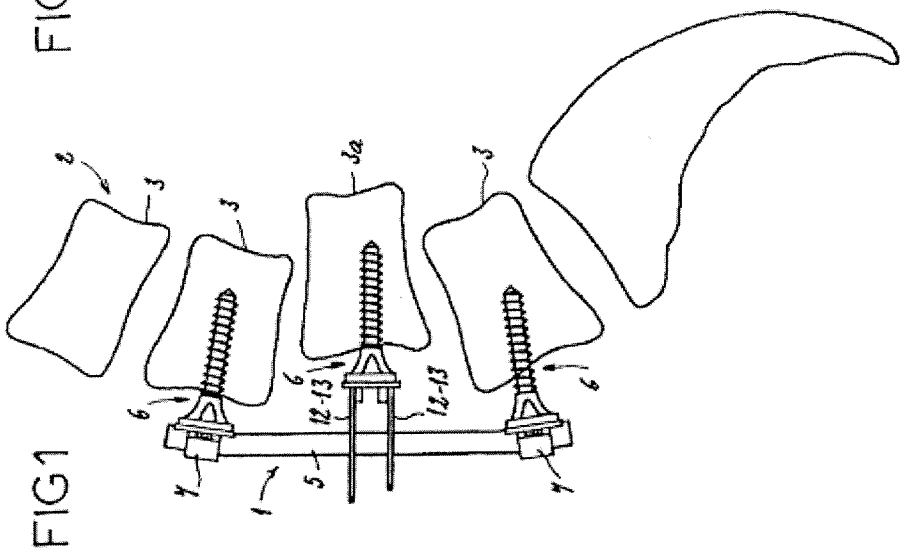


FIG 1

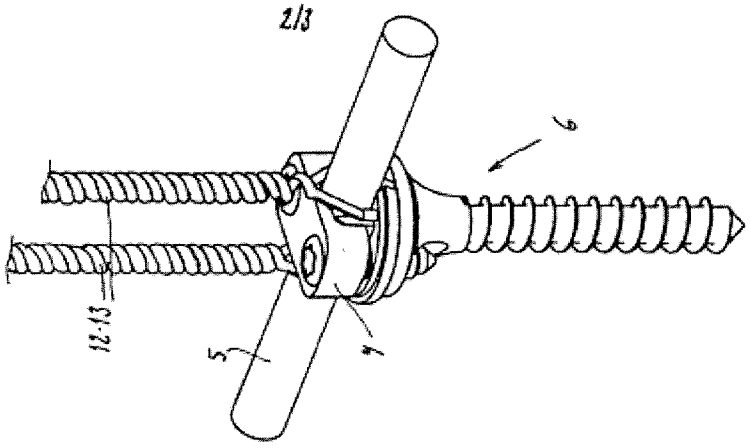


FIG 6

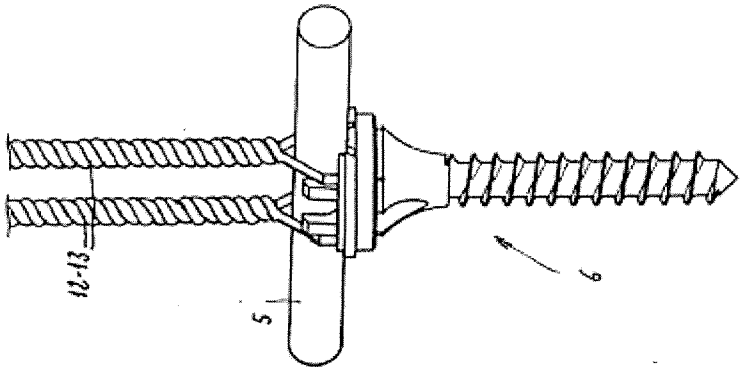


FIG 5

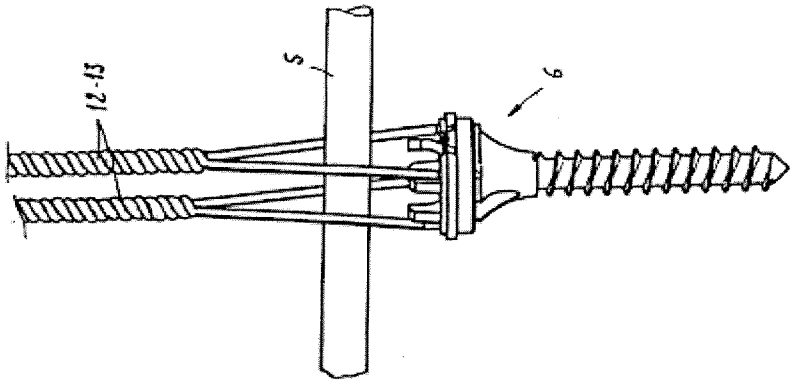


FIG 4

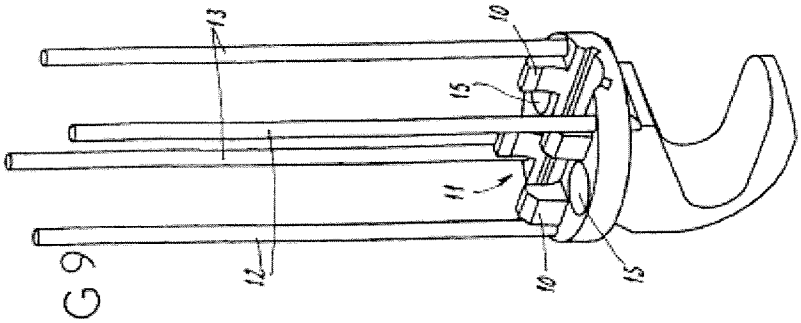


FIG 9

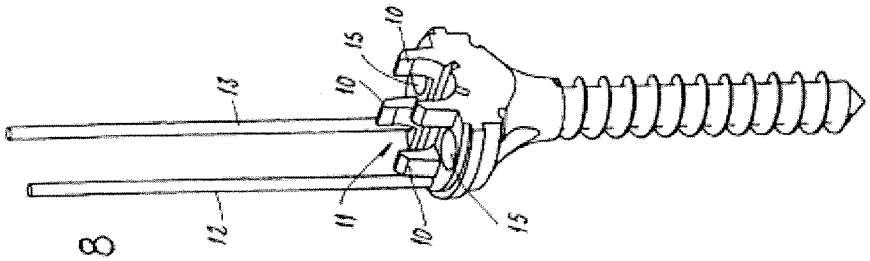


FIG 8

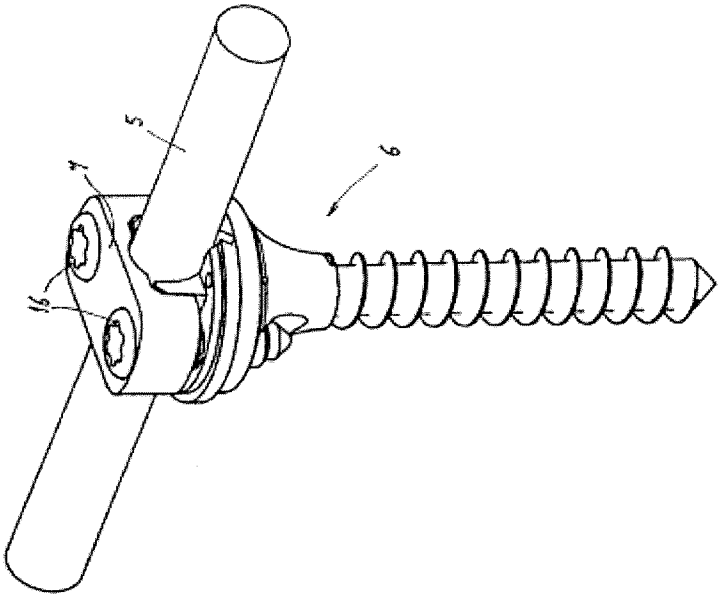


FIG 7

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CERTIFICATION

This is to certify that the attached, to the best of my knowledge and belief, is a true and accurate translation into English of "Patent No. FR 2801492," dated 10/23/2006, originally written in French.

Glenn Cain
Manager of Legal Translation Services
The LanguageWorks, Inc.

Sworn to and subscribed before me,
This Twenty-third day of October, 2006.

Notary Public

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